

FT-890

Technical Supplement



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Introduction



This manual provides technical information necessary for servicing the Yaesu FT-890 HF Transceiver. It does not include information on specifications, installation and operation, which are described in the *FT-890 Operating Manual*, provided with each transceiver, or on FT-890 accessories, which are described in manuals provided with each.

Servicing this equipment requires expertise in handling surface mount chip components. Attempts by non-qualified persons to service this equipment may result in permanent damage not covered by warranty.

For the major circuit boards, each side of the board is identified by the type of the majority of components installed on that side. In most cases one side has only chip components, and the

other has either a mixture of both chip and lead components (trimmers, coils, electrolytic capacitors, packaged ICs, etc.), or lead components only.

While we believe the technical information in this manual is correct, Yaesu assumes no liability for damage that may occur as a result of typographical or other errors that may be present. Your cooperation in pointing out any inconsistencies in the technical information would be appreciated.

Yaesu Musen reserves the right to make changes in this transceiver and the alignment procedures, in the interest of technological improvement, without notification of the owners.

Circuit Board Access

- ❑ Turn the transceiver off and disconnect all cables.
- ❑ Place the set upside-down on the work surface, with the rear facing you, and remove the 8 screws affixing the bottom cover (photos 1 & 2). This exposes the component side of the RF Unit.
- ❑ To remove the top cover, disconnect the light-blue-banded coaxial cable from J2026 near the rear of the exposed RF Unit (photo 3).
- ❑ Note: the cable must be reconnected to J2026 during alignment (except for Local Unit and PA Unit procedures).
- ❑ Place the transceiver topside-up so the rear panel is facing you, and remove the 4 screws indicated in photo 4.
- ❑ Remove the 4 screws in the shield panel at the left, as shown in photo 5, to access the Local Unit.
- ❑ Remove the 11 screws in the shield panel at the right to access the PA, LPF and Keyer Units.

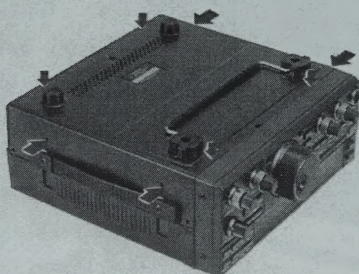


Photo 1

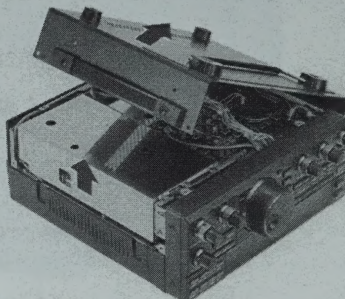


Photo 2

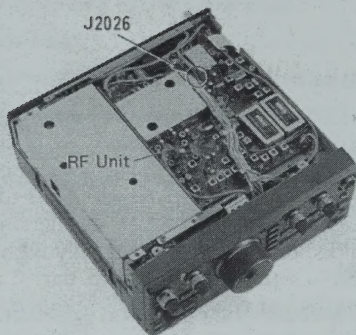


Photo 3



Photo 4

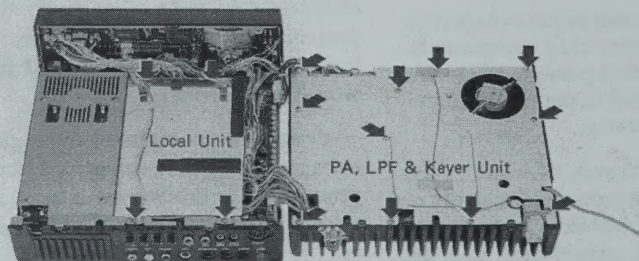
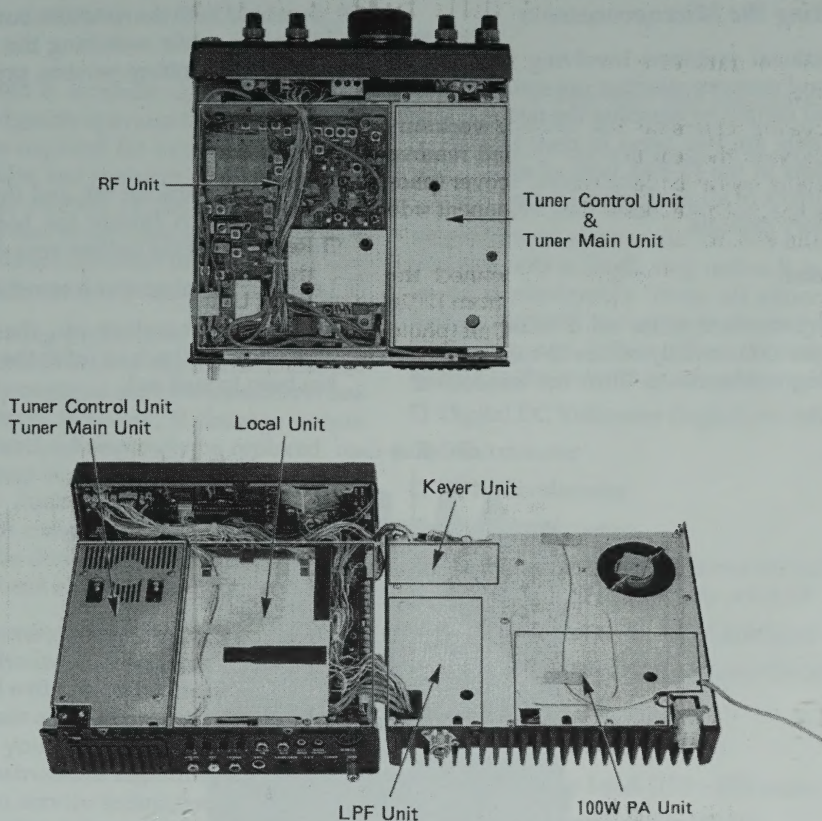
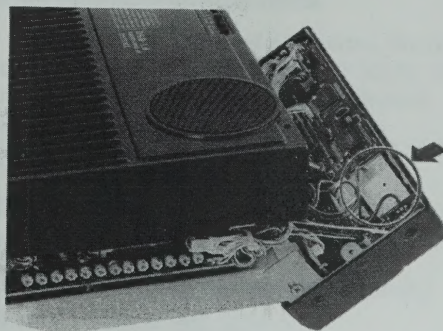
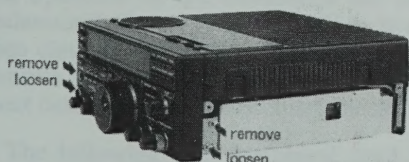


Photo 5



Battery & Pilot Lamp Replacement

- ☐ Disconnect all cables and remove the top and bottom covers.
- ☐ Remove the 4 screws from both sides of the front panel, as indicated below (for pilot lamp replacement, the bottom two screws can be just loosened).
- ☐ Gently pull the front panel away from the chassis (or just fold it down for pilot lamp replacement).
- ☐ Pilot lamp location is indicated below. To change the backup cell, use your fingers to remove the old cell from its holder (do not grab it with metal tweezers or pliers, as that could short it out). Replace only with Sony lithium type CR2032 (Yaesu part number Q900564), or equivalent.



Resetting the Microprocessors

Functional problems involving frequency, mode and memory selection can sometimes be resolved simply by resetting the microprocessors. There are two ways to reset the microprocessors in the FT-890, both of which clear the contents of all memories, leaving them at the factory defaults.

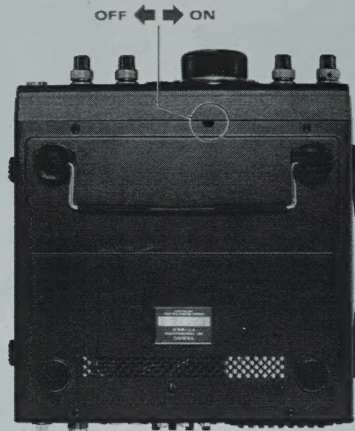
Soft Reset

This procedure relies on a ROM routine which should normally suffice to correct most operating misfunctions. Turn the transceiver

off, then hold both the **HAM/GEN** button and the **CLAR** button while switching the transceiver back on. If the problem persists, proceed to the Hard Reset.

Hard Reset

- ☐ Turn the transceiver off, and then turn the Backup switch (inside the hole near the front center of the bottom cover) off.
- ☐ Let the transceiver sit for several minutes.
- ☐ Turn the transceiver on, then turn the Backup switch back on (after the transceiver has been turned on).



Alignment

The FT-890 is carefully designed to allow the knowledgeable operator to make nearly all adjustments required for various station conditions, modes and operator preferences simply from the controls on the panels, without opening the case of the transceiver. The *FT-890 Operating Manual* describes these adjustments, plus certain internal settings.

The following procedures cover the sometimes critical and tedious adjustments that are not normally required once the transceiver has left the factory. However, if damage occurs and some parts subsequently be replaced, realignment may be required. If a sudden problem occurs during normal operation, it is likely due to component failure; realignment should not be done until after the faulty component has been replaced.

We recommend that servicing be performed only by authorized Yaesu service technicians, experienced with the circuitry and fully equipped for repair and alignment. So if a fault is suspected, you should contact the selling dealer for instructions regarding repair. Authorized Yaesu service technicians have the latest modification information, and realign all circuits and make complete performance checks to ensure compliance with factory specifications after replacing faulty components.

Those who do undertake any of the following alignments are cautioned to proceed at their own risk. Problems caused by unauthorized attempts at realignment are not covered by the warranty policy. Also, Yaesu must reserve the right to change circuits and alignment procedures in the interest of improved performance, without notifying owners.

Under no circumstances should any alignment be attempted unless the normal function and operation of the transceiver are clearly understood, the cause of the malfunction has been clearly pinpointed and any faulty components replaced, and the need for realignment determined to be absolutely necessary.

The following test equipment (and thorough familiarity with its correct use) is necessary for complete realignment. Correction of problems caused by misalignment resulting

from use of improper test equipment is not covered under the warranty policy. While most steps do not require all of the equipment listed, the interactions of some adjustments may require that more complex adjustments be performed afterwards. Do not attempt to perform only a single step unless it is clearly isolated electrically from all other steps. Rather, have all test equipment ready before beginning, and follow all of the steps in a section in the order they are presented.

- ☐ Digital DC Voltmeter (high-Z, >1 M Ω /V)
- ☐ DC Ammeter
- ☐ RF Millivoltmeter
- ☐ AF Millivoltmeter
- ☐ RF Standard Signal Generator w/ calibrated output and dB scale, 0 dB μ = 0.5 μ V
- ☐ AF Signal Generator with calibrated output
- ☐ Spectrum Analyzer or receiver (30 MHz)
- ☐ Oscilloscope
- ☐ Frequency Counter
- ☐ 50- Ω Dummy Load (150 ~ 250 watts)
- ☐ 16.6- Ω Dummy Load (>150 W)
- ☐ In-Line Wattmeter (150 ~ 250 W, 50- Ω)
- ☐ Linear Detector
- ☐ RF Attenuator (>150-W, 40-dB) or coupler

Alignment Preparation & Precautions

A 50- Ω dummy load and inline wattmeter must be connected to the antenna jack in all procedures that call for transmission, except where specified otherwise. Correct alignment is not possible with an antenna.

Except where specified otherwise, the transceiver should be tuned to 14.2 MHz, USB mode, and these controls set as indicated:

- ☐ **MOX & VOX** buttons OFF (■)
- ☐ **AGC-F** button ON (■)
- ☐ **PROC, IPO, ATT & RPT/T** buttons OFF (■)
- ☐ **MIC & RF PWR** fully ccw (minimum)
- ☐ **AF** as required, **RF** fully cw (maximum)
- ☐ **NB** 12-o'clock, **SQL** fully ccw
- ☐ **NOTCH & SHIFT** to 12-o'clock

After completing one step, read the following step to determine whether the same test equipment will be required. If not, remove the test equipment (except dummy load and wattmeter, if connected) before proceeding.

Correct alignment requires that the ambient temperature be the same as that of the transceiver and test equipment, and that this temperature be held constant between 20 and 30 °C (68 ~ 86 °F). If the transceiver is brought into the shop from hot or cold air it should be allowed some time for thermal equalization with the environment before alignment.

Alignments must only be made with oscillator shields and circuit boards firmly affixed in place. Only one extender board should be installed at a time for access to the board being aligned. Also, the test equipment must be thoroughly warmed up before beginning.

Note: Signal levels in dB referred to in alignment are based on 0 dBμ = 0.5 μV.

Table note: DC voltages should be within ± 10% of those listed in the voltage tables.

Local Unit

Refer to the Local Unit Alignment Diagram on page 3-10. To prevent PLL unlock from interfering with the Local Unit alignment process, connect TP1008 to ground. Remember to disconnect TP1008 when finished alignment.

Reference Oscillator

- ☐ Connect the frequency counter to TP1004.
- ☐ If the counter frequency differs by more than 5 Hz from 10.485760 MHz, adjust the TCXO-3 trimmer (if the TCXO is installed) or TC1002.
- ☐ Replace the counter with the RF millivoltmeter, and confirm at least 120 mV_{rms}.

70-MHz 2nd Local Oscillator

- ☐ Remove the coaxial plug from J1003 and connect a 50-Ω resistor in parallel with the frequency counter across the socket.
- ☐ Adjust L1002 for 70.00000 MHz ± 20 Hz.
- ☐ Replace the counter with the RF millivoltmeter, and confirm at least 40 mV_{rms}.

- ☐ Remove the meter and resistor, and replace the plug in J1003.

Carrier DDS Check

- ☐ Turn the **MIC** and **RF PWR** controls fully ccw (minimum), and connect the frequency counter to TP1009.
- ☐ Select LSB mode, key the transmitter, and confirm 453.500 kHz on the counter.
- ☐ Select USB mode, key the transmitter, and confirm 456.500 kHz on the counter.
- ☐ Select CW mode, key the transmitter, and confirm 455.800 kHz on the counter.
- ☐ Select AM mode, key the transmitter, and confirm 455.000 kHz on the counter.
- ☐ Connect the RF millivoltmeter to TP1009 and at least 80 mV_{rms} in USB mode.

Sub-Loop: DDS Check

Tune the transceiver display to 7.0451 MHz. Connect the RF millivoltmeter to TP1010 and confirm at least 40 mV_{rms}.

Sub-Loop: DDS Check

- ☐ Tune the transceiver display to 7.04511 MHz. Connect the frequency counter to TP1007 and adjust L1045, if necessary, for 60 to 60.1 MHz on the counter.
- ☐ Connect the RF millivoltmeter to TP1011 and adjust T1002 and T1003 alternately several times for maximum RF voltage.
- ☐ Connect the DC voltmeter to TP1001 and adjust L1045 for 5.0 ± 0.2 V.
- ☐ Tune the transceiver up 10 Hz to 7.04512 MHz and confirm 3.0 ± 0.2 V at TP1001.
- ☐ Tune the transceiver to 7.1270 MHz, connect the RF millivoltmeter to TP1012, and adjust T1002 and T1003 alternately (again) several times for maximum RF voltage (at least 10 mV_{rms}).

Main PLL: Local BPF & VCV

- ☐ Tune the transceiver to 7.1400 MHz, and connect the RF millivoltmeter to TP1002 (pin 13 of Q1042).
- ☐ Adjust T1005 and T1006 alternately several times for peak RF voltage (at least 100 mV_{rms}). Leave the meter at TP1002.

- Connect the DC voltmeter to TP1003. Tune the display to each adjustment frequency in the following table and adjust the corresponding trimmer capacitor for 6.0 ± 0.2 V on the DC voltmeter. Then retune to the check frequency and confirm the corresponding check voltage (± 0.5 V). Repeat at each listed frequency.

Adjustment Freq. (VCO#)	Adj. for 6 V @TP1003	Check	
		Freq.	Volts
30.00000 (VCO4)	TC1005	21.50000	1.8
21.49999 (VCO3)	TC1004	14.50000	1.8
14.49999 (VCO2)	TC1003	7.50000	1.6
7.49999 (VCO1)	TC1001	0.10000	1.7

- Tune the transceiver to 29.9800 MHz and again adjust T1005 and T1006 alternately several times for peak RF voltage (at least 100 mV_{rms}) at TP1002.

1st Local Output Level Check

- Remove the plug from J1001 and connect a 50-Ω resistor and RF voltmeter in its place.
- Tune to 30.00000 MHz and confirm at least 400 mV_{rms} on the meter. Replace the plug in J1001.

PA Unit (RF Power Amplifier)

Final Idling Current

Make sure the transceiver has been on for at least several minutes. Connect the DC voltmeter between TP4001 (+) and TP4002 (—) on the PA Unit. Key the transmitter in an SSB mode, and with no microphone input, adjust VR4001 for $6.0 \text{ mV} \pm 0.5 \text{ mV}$.

LPF Unit

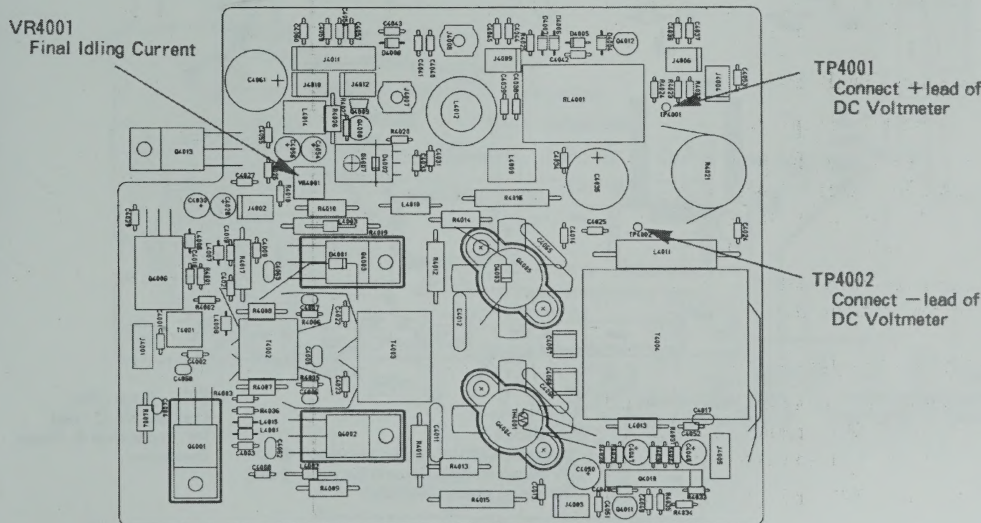
CM Coupler Balance

With the 50-Ω dummy load connected to the antenna jack, tune the transceiver to 14.2 MHz, and select the CW mode. Connect the DC voltmeter between pins 3 (—) and 4 (+) of J5006, key the transmitter and adjust TC5001 for *minimum* on the voltmeter.

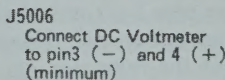
Tuner Unit

Tuning Capacitor/Motor (Mechanical Check, Setting & Adjustment)

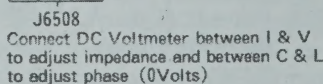
- Loosen all set screws in the shaft coupler, and turn the coupler by hand to confirm it moves freely (the motor and capacitor should not move). If the coupler binds, check the motor mounting position (it is



100-W Power Amp (PA) Unit Test & Alignment Points



LPF Unit Test & Alignment Points



Tuner Control Unit Test & Alignment Points

soldered in place) and the capacitor mounting (screws).

- ☐ Turn the power switch off, and jump TP6501 to chassis ground.
- ☐ Turn the power switch on. The motor should rotate, and then stop.
- ☐ Set the capacitor to its maximum capacitance position (plates fully meshed) by hand, and tighten all shaft coupler set screws, using care not to disturb the capacitor or motor positions.
- ☐ Turn the power off, and jumper TP6502 to chassis ground (along with TP6501).
- ☐ Turn the power back on. The motor should move 180°, and the capacitor should be then at minimum capacitance (fully unmeshed).
- ☐ Remove the grounding jumpers from TP6501 and TP6502.

Tuner Impedance & Phase Detection

- ☐ Connect the 50-Ω dummy load and wattmeter to J6501 (the output of the Tuner Control Unit), and connect J6502 (RF IN) to J5002 (LPF OUT). Tune the transceiver to 14.000 MHz, CW mode.
- ☐ Connect the DC voltmeter between pins 1 ("I") and 2 ("V") of J6508 (either polarity).

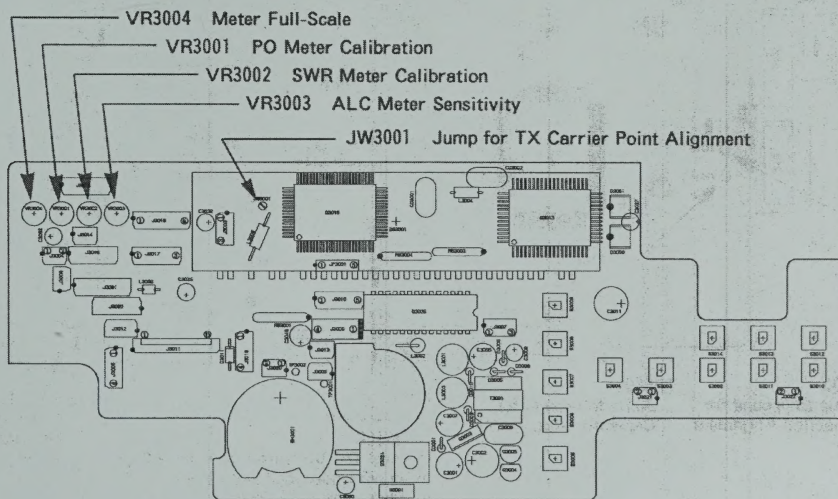
- ☐ Press the **TUNER** and **MOX** buttons, adjust the **RF PWR** control for 50 watts output, and then adjust TC6501, if necessary, for meter indication within ± 0.08 V of 0 V.
- ☐ While still transmitting, move the DC voltmeter to pins 3 ("C") and 4 ("L") of J6508 (either polarity), and adjust VR6501, if necessary, for meter indication within ± 0.02 V of 0 V.

RF Unit Local Signals and Oscillators

- ☐ With the RF millivoltmeter, confirm at least 900 mV_{rms} at TP2001, and 400 mV_{rms} at TP2002 (see page 3-11).

Notch Oscillator

- ☐ Connect the frequency counter to TP2004 (pin 7 of Q2020), and with the **NOTCH** control at 12 o'clock, adjust L2062 for 8.67 MHz ± 50 Hz.
- ☐ Replace the counter with the RF voltmeter, and adjust T2032 for maximum voltage (at least 300 mV_{rms}).



Display Unit Test & Alignment Points

